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# A Monetarist Model of Equity Valuation.

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# A MONETARIST MODEL OF EQUITY VALUATION

BY

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This thesis is approved as a creditable and independent investigation by a candidate for the degree, Master of Science, and is acceptable as meeting the thesis requirements for this degree. Acceptance of this thesis does not imply that the conclusions reached by the candidate are necessarily the conclusions of the major department.

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# Chapter 1

## INTRODUCTION

Prior to 1945, few academic articles had been addressed to the area of equity valuation models. Since that time, with the advances of analytic economics and in particular the theory of interest rates, several formal equity valuation models have been developed. Several of the models myopically concentrated on microeconomic variables resulting in their inability to discern cyclical shifts in aggregate equity value indices. This shortcoming has been rectified by economists who have tended toward the reemerging monetarist school of thought. The result has been the construction of models designed to examine the movement of aggregate equity share price indices with regard to aggregate macroeconomic variables.

A basic distinguishing characteristic of the monetarist school of thought is its emphasis on the effects of changes in the nominal money supply on the aggregate level of economic activity. A key variable through which these changes transmit their effects is the interest rate.

The early monetarists viewed interest rates as the equilibrating mechanism between the demand for capital goods and the supply of loanable funds. One of the first to espouse this theory was Böhm-Bawerk[1]

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[1]Friedrich A. Lutz, The Theory of Interest, (Chicago: Aldine Publishing Company, 1968), pp. 129-130.

who introduced it while explaining the correlation between money and interest rates. His argument maintained that increases in the money supply and hence increases in money held by banks, caused a reduction of the interest rate on bank credit. But this was a short-term effect. As the excess money poured into the channels of the commodity markets, purchasing power was reduced. Money prices of all commodities including real capital goods would rise. Ultimately, more units of money than previously would be required to transfer the same amount of real capital goods. At this point, the increased supply of money which had initially pressed on the market as excess supply would be completely absorbed by the demand for money capital which would arise from the marginal rate of return on capital. Eventually, the disturbed equilibrium between supply and demand would be restored, and the normal interest rate corresponding to the actual supply of real capital would be re-established.

Wicksell[2] developed a similar though more detailed line of thought in his book Interest and Prices. In it, he showed how the banking system could keep the interest rate on bank credit (the money rate of interest) below the natural rate of interest.[3] This condition would lead to a general rise in prices which could be brought to a standstill only when the money rate of interest was raised to the level of the natural rate. In essence, he was addressing the issue of money

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[2]Ibid., p. 130.

[3]The rate determined by the supply of productive factors and the function relating the volume of output produced by labor to the period of production.

interest rates as the equilibrating mechanism between the demand for capital goods and the supply of loanable funds.

From the times when Böhm-Bawerk and Wicksell wrote, the interest rate has been used, by those using the loanable funds theory, as the equilibrating mechanism between the money supply and the cost of debt. With the advent of the writings of Milton Friedman, economists began to seriously consider alternative forms of wealth as being affected by changes in the money supply and interest rate. Among the alternative forms, and the one with which this paper will deal, was equities.

It is the intent of this research effort to link relevant macroeconomic aggregates to an equity share price index through a model based on monetarist thinking and specifically a loanable funds type theory of interest rates. Of primary importance will be the demonstration of the money supply's effect upon an aggregate equity share index.

Chapter 2 contains a review and critique of previous studies done in the area of equity share price models. Chapter 3 presents the model to be used. Chapter 4 contains the data used and empirical results obtained from the model's evaluation. Recommendations for future studies are presented in Chapter 5.

## Chapter 2

## REVIEW AND CRITIQUE OF PREVIOUS STUDIES

Early equity share valuation models concentrated on microeconomic variables to explain the determinants of equity share pricing. In 1952, one of the more notable models was developed by David Durand[1] to measure the relative importance of those variables that might affect bank stock prices. Durand believed that the feasibility of a bank advantageously acquiring money capital through a stock flotation depended upon whether or not that stock sold for more than its book value.[2] Although banks could sell equity shares at less than book value, the opportunity cost would be enormously high.

Durand cited a hypothetical example to illustrate this concept.[3] A corporation wishes to obtain five million dollars through the sale of equity shares. Prior to the issue, that corporation's stock sells for 23 dollars and earns three dollars per share. The investment banker will take the stock at 20 dollars a share and put it on the market at 22 dollars. 250,000 shares must be sold for the banker to raise the

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[1]Michael Keran, "Models of Equity Valuation: The Great SERM Bubble," The Journal of Finance, Vol. 25, No. 2, (May, 1970), pp. 245-246.

[2]The book value was regarded as the break-even point in that it was equal to the expected return from the money capital minus the cost of financing by this form of security.

[3]Myron J. Gordon, The Investment, Financing, and Valuation of the Corporation, (Homewood, Illinois: Richard D. Irwin, Inc., 1962), p. 115.

required money capital. The question was, what rate of return on the money capital would the bank have to earn in order to maintain the price of the stock at 23 dollars? Durand set out to find those factors that would keep the value of the stock at or above book value.

The original model was:[4]

$$P = a(Ni/NW)^{e} \ (dV/Ni)^{f} \ (NW) \ (\varepsilon) \qquad (1)$$

Where: P = the price of the equity share

Ni = net income

dV = dividend

NW = net worth

$\varepsilon$ = the stochastic element

This equation reduced to:

$$P = a \ (Ni)^{e-f} \ (dV)^{f} \ (NW)^{1-e} \ (\varepsilon). \qquad (2)$$

Letting e-f = b, f = c, 1-e = d, the final equation tested was:

$$P = a(Ni)^{b} \ (dV)^{c} \ (NW)^{d} \ (\varepsilon) \qquad (3)$$

The results of the testing of this model were that the parameter estimates were almost completely sample sensitive. That is, the magnitude of the equation's parameters varied from one sample to the next.

Durand's model does not consider any macroeconomic variables.[5]

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[4]Keran, op. cit., p. 246.

[5]This statement must be tempered by the fact that the net income of a bank is functionally related to the level of the interest rate.

The inclusion of solely microeconomic variables implies that Durand felt that the price per share of bank common stock was exempt from the influences of general economic conditions. It would seem that factors such as the rate of change in GNP or rate of inflation would also affect the value that a potential equity share buyer would attach to a bank stock. The model presented in Chapter 3 will contain GNP and price variables.

A more elaborate model was constructed by Myron Gordon.[6] The purpose of the monogram containing this model was to arrive at the investment and financing actions a corporation should take given that its objective was to increase the per share market value of its common stock.[7]

In his study, Gordon meticulously covered the components of the six variables he felt were possible contributors to an equity valuation process. These variables were dividends per share, expected growth rate of dividends, a measure of earnings stability, a measure of a firm's leverage, an index of operating assets liquidity and a measure of a

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[6]Gordon, op. cit., pp. 1-239.

[7]Jules I. Bogen, (ed.), Financial Handbook, (New York: The Ronald Press Company, 1964), p. 2026. Market value is a function of estimates of earning power, dividend policies, book value, value of the underlying property, capital structure, and size of a company, competitive position, and the character of management.

firms size.[8] The actual equation was:

$$P = \frac{Y_o\,(1-b)\,(1 + rb + v_q)^{\alpha 2}\,S^{\alpha 7}}{\alpha_o\,(1 + \hat{\sigma}/W_o)^{\alpha 3}\,(1 + h - ih/\hat{k})^{\alpha 4}\,\pi^{\alpha 5}\,u^{\alpha 6}\,(1 + q)^{\alpha 8}} \qquad (4)^{9}$$

Where: Y = earnings per share without leverage

b = retained earnings

r = the rate of return on common equity investment

v = the fraction of funds invested by new stockholders which accrues to the equity of the existing stockholders

q = funds raised through outside equity financing

S = index of a corporation's size

$\hat{\sigma}$ = standard deviation of a probability distribution

W = a corporation's net worth

h = leverage rate of debt equity ratio

$\hat{k}$ = rate of return investors require on a share

$\pi$ = operating asset liquidity index

i = the interest rate

u = debt maturity index

The following equation was fitted for several industries:

$$\ln P = \ln\alpha_0 + \alpha_1 \ln D + \alpha_2 \ln (1 + br + vq) + \alpha_3 \ln (1 + \hat{\sigma}/W) + \alpha_4 \ln (1 + h - ih/\hat{k}) + \alpha_5 \ln \pi + \alpha_7 \ln S + \alpha_8 (1 + q) \qquad (5)^{10}$$

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[8]Keran, op. cit., p. 249.

[9]Gordon, op. cit., p. 124.

[10]Ibid., p. 170.

Where: D = dividend on a share of equity.

Coefficients of determination ranged from .83 to .938. These results were suspect because of the degree of collinearity between several of the variables.

Gordon's study is an in-depth analysis of the microeconomic variables that affect equity share pricing. The inclusion of the interest rate as a variable makes this model one of the first to consider macroeconomic variables.

Two other contributors to equity valuation literature are Beryl Sprinkel and Michael Keran, both monetarists. Their approach differs from previously mentioned authors since they were mainly concerned with the influences of macroeconomic variables on the price of stocks.

Beryl Sprinkel, in his book, Money and Markets, A Monetarist View, maintained that the nominal money supply must be viewed by the public as being exogenous.[11] The demand for money tends to be a stable function varying with factors such as real income and interest rates. Spending units desire to hold larger amounts of money the higher their level of income. Also, at lower interest rates, spending units will be willing to hold greater amounts of money since the cost of maintaining liquidity is reduced.

In explaining the monetarist view of equity share valuation,[12] Sprinkel began by pointing out that the Federal Reserve System is the

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[11]Beryl W. Sprinkel, Money and Markets, A Monetarist View (Homewood, Illinois: Richard D. Irwin, Inc., 1971), pp. 32-33.

[12]Sprinkel, op. cot., p. 230.

economy's basic source of liquidity. The expansion phase of a business cycle decreased liquidity, causing spending units to attempt to conserve on cash balances. During this expansion phase, interest rates typically rise as capital goods purchases increase. The increase in interest rate adds to the incentive to reduce cash balances. The opportunity cost of holding large cash balances increases, causing the velocity of money to increase. As the liquidity squeeze intensifies relative to liquidity desires, adjustments are made. Spending units attempt to shift from less liquid to more liquid assets.[13] There are fewer purchases of less liquid assets such as stocks. The tendency is to shift from stock purchases to bond purchases, bonds being a more liquid asset. The high cost of debt financing due to high interest rates and the high cost of equity financing due to low common stock prices decreases the rate of increase of aggregate investment.[14] Spending units affected by the high cost of debt and equity financing finally resort to decreasing expenditures relative to income. Corporation profits decline and the economy moves toward recession.

During a recession, as the rate of increase or the actual rate of investment and income decrease, interest rates decline causing the

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[13]Wallace C. Peterson, Income, Employment, and Economic Growth (New York: W. W. Norton and Company, Inc., 1967), p. 305. Liquidity is defined as a relative index of the ease of conversion from one form of wealth to another form of wealth without loss of value.

[14]The decrease in the rate of investment causes a decrease in capital accumulation which in turn causes a decrease in the rate of employment in capital producing companies. Employment decreases in this sector of the economy will tend to decrease aggregate income and consequently, aggregate demand.

market value of assets to increase. Less liquid assets become more desirable. The changing interest pattern encourages this shift. As liquidity increases, stock prices respond by ceasing to decline and eventually by increasing.

Sprinkel noted[15] that business cycle turning points were preceded by both money supply and aggregate equity share price index changes. The increase in the money supply appeared to have the longer lag of the two variables. Upward changes in the money supply led business cycle peaks by almost 16 months as compared to the five to six month average lead of equity share price changes. Changes in monetary growth led cyclical upturn by about eight months whereas stock price upturns occurred about four to five months prior to business upturns. Changes in monetary growth led changes in stock prices by an average of nine months prior to a bear market and two or three months prior to a bull market.[16]

The first weakness of the study is that Sprinkel did not develop a stochastic model explaining the equilibrating mechanism that was capable of specifying the relation between changes in the money supply and common stock values. The second weakness of Sprinkel's study was that no pattern was suggested for lags. Sprinkel presented the historical range for lags between peaks in the growth rate of the money supply and peaks in the growth rate of stock prices. He determined that the lags ranged from 1 to 17 months with an average of 8.8. However, he did not present a model of the adjustment mechanism that would explain the

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[15]Sprinkel, op. cit., p. 24.

[16]Ibid., p. 221.

lag structure.

Another monetarist addressing the problem of equity share valuation was Michael Keran.[17] His model was a by-product of work done in the development of the St. Louis model, an eight equation predictive model developed by the St. Louis Federal Reserve. Keran's model sought a rational explanation for movements in equity share prices that was consistent with microeconomic price theory and which could be tested against time series data. He demonstrated that the standard theory of stock price determinants (discounted to present value of expected corporate earnings) provided a solid theoretical base for a reasonable explanation of stock price movements in the past 15 years. The major factors he found that were instrumental in determining nominal stock prices were expected corporate earning, as determined by the Almon distributed lag technique, and current interest rates. In Keran's model, the interest rate was determined to be functionally related to inflation expectations, the real growth rate of gross national product, and changes in the real money supply.

The results obtained from testing the model indicated that increased earnings expectations tended to increase the equity share price index, while increased interest rates tended to depress the index. Changes in the nominal money supply had little direct effect on the stock price index, but it was shown that these changes have a major effect indirectly because of their predominant effect on inflation and corporate

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[17]Michael W. Keran, "Expectations, Money, and the Stock Market," Federal Reserve Bank of St. Louis Review, Vol. 53, No. 1, (January, 1971), pp. 16-31.

earnings expectations.

## SUMMARY

Durand was one of the first economists to derive a quantitative model to explain equity share prices. The objection raised to his study was that only microeconomic variables were introduced.

Gordon advanced the development of equity share model building by adding a macroeconomically determined variable, the interest rate, into his model, thereby taking an initial step toward rectifying Durand's omission. The main emphasis though, was on extensively explaining and testing his 12 microeconomic variables.

Sprinkel's presentation reversed the emphasis from microeconomic variables to macroeconomic variables. Within the context of monetarist theory, Sprinkel developed an explanation of the equity valuation process. However, he did not develop a mathematical model capable of specification. He did, however, empirically substantiate his argument by inspecting historical data.

Keran's model filled the gap left by Sprinkel. Keran's model developed a mathematical model capable of specification. This model considered the interaction of macroeconomic variables as theorized in the loanable funds theory of interest, and monetarist theory. The deficiency of the presentation was that the theory and the equations that led to the final equation which was to be tested suggested a logarithmic form for the variables. Instead, Keran presented the variables in an additive form.

The model presented in Chapter 3 has drawn from all the models presented in Chapter 2. It is a quantitative economic model. As in Gordon's model, interest rates are a factor, but the theory underlying the application of interest rates to equity share prices is drawn from Keran's study. The underlying theory for the entire model is monetarist in nature.

# Chapter 3

## MODEL

### INTRODUCTION

A fundamental contention of the monetarist school of thought is that wealth can be held in many forms. Each form yields a flow of returns. The wealth-owning unit maintains a portfolio, i.e., an itemized list of various forms of wealth, that is diversified and tends toward equilibrium with respect to the real and nominal returns from each form of wealth. The wealth-owner apportions his wealth such that the "rate at which he can substitute one form of wealth for another is just equal to the rate at which he is willing to do so."[1]

Assume that the wealth-owning unit has a portfolio in equilibrium with respect to the real and nominal rates of return from the various forms of wealth. Assume further that the real and nominal rate of return of one form of wealth is changed. The composition of the portfolio must be adjusted. In the aggregate, this adjustment process will change prices through supply and demand adjustments, and the real and nominal returns from all components of wealth will again be equilibrated.

For the given wealth-owning unit, assume, as Friedman does, that

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[1]Milton Friedman, The Optimum Quantity of Money and Other Essays, (Chicago: Aldine Publishing Company, 1969), p. 53.

money is held as part of the wealth portfolio.[2] If the monetary authority decides to purchase government securities, the price of those securities will be increased making it advantageous for owners of government securities to exchange the securities for money. Through this process, the Federal Reserve increases the nominal money supply.

When the non-bank seller of government securities receives money in exchange for those securities, he initially deposits that money with the banking system. Excess reserves are created which become someone else's debt. Through the money multiplier process, the quantity of money increases. The increase in the money supply will cause the demand for financial and non-financial goods to shift upward causing a general increase in the price level.

Part of the money received by the non-bank seller of government securities will be used to purchase assets similar[3] to those sold. As the demand for similar securities intensifies, the price of these securities increases. Therefore, the real rate of return of those securities decreases causing the wealth-owner to seek alternative assets with higher real rates of return. Eventually, all real and nominal rates of return approach equilibrium as prices adjust. Since all nominal rates of return tend toward equilibrium, all rates of return are

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[2]David E. W. Laidler, The Demand for Money: Theories and Evidence (Scranton, Pennsylvania: International Textbook Company, 1969), p. 56.

[3]Securities possessing like degrees of liquidity.

functionally related to one nominal rate of return.[4]

Return to Equity Shares

One component of wealth is equity shares. The real and nominal returns from this form of wealth can be represented by the real and nominal earnings to price ratio, respectively. The net earnings of the corporation go either to dividends or to retained earnings. Dividends may be viewed by some share holders as the return from equity shares. However, retained earnings also comprise a component of returns from equity shares. Retained earnings are re-invested, increasing the stockholder equity or the net worth of the firm. Assuming competent management, per share earnings should increase as a result of the increase in the firm's net worth. If the price to earnings ratio remains constant, then the per share price of the equity will increase. Thus, the equity holder will realize a return from retained earnings through an increase in the price of the equity.

Real Returns to Equity Shares

If the equity yields in real terms are a function of real bond yields, then the real price to earnings ratios must be functionally related to real bond yields also, or:

$$\frac{E_t/P_t}{ESP_t/P_t} = f_1(rm_t, \varepsilon_1), \frac{\partial f_1}{\partial rm} > 0 \qquad (1)$$

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[4]Likewise, all real rates of return tend toward equilibrium and are functionally related to one real rate of return.

Where $E_t$ = nominal earnings at time t.[5]

$P_t$ = the price level at time t.

$ESP_t$ = an aggregate index of equity share prices at time t.

$rm_t$ = the real market rate of interest at time t.

$\epsilon$ = a stochastic element representing shocks and disturbances from other sources.

Equation (1) states that the real return from equity shares is functionally related to the real returns from debt instruments.

By functionally solving for $ESP_t/P_t$ in equation (1):

$$\frac{ESP_t}{P_t} = f_2\ (E_t/P_t,\ rm_t,\ \epsilon_2);\ \frac{\partial f_2}{\frac{E_t}{\partial P_t}} > 0,\ \frac{\partial f_2}{\partial rm_t} < 0. \qquad (2)$$

To find the degree to which variables are related, a functional relationship must be fitted empirically. To do this, functional variables must be put into a form compatible with the technique of regression. One technique that can be used is the linearization of the functional relation. In linear form equation (2) becomes:

$$RESP = a_0 + a_1RE + a_2rm + \epsilon_2. \qquad (3)$$

Where: $a_0$ = the Y-axis intercept

RESP = real equity share price index

RE = real earnings.

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[5]Some past studies have used an expectations of earnings variable as a determinant of equity share prices. This study, on the other hand, used present earnings. The determinants of present earnings will be examined later.

The result of the regression should show that positive real earnings are positively related to real equity share prices since an increase in real earnings would necessitate an increase in real equity share prices to maintain a real rate of return comparable to other rates of return from other forms of wealth. The real rate of interest, on the other hand, should be negatively related to real equity share prices since an increase in real interest rates is indicative of an increase in the real rates of return from other forms of wealth. The real rate of return from equity shares, as is represented on the left side of equation (1), can be equilibrated to other real rates of return by the wealth-owner causing real equity share prices to decrease.

It is possible that the relationship between real equity share prices, real earnings and the real rate of interest could best be explained by regressing a logarithmic linear stochastic form of functional equation (2). By using the logarithmic form, a multiplicative form of the non-logarithmic relationship is implied. In logarithmic form, equation (2) becomes:

$$\ln RESP = \ln a_{10} + a_{11} \ln RE + a_{12} \ln rm + \ln \varepsilon_2. \qquad (4)$$

The advantage of using this form of the equation is that the regression coefficients are the elasticities of the dependent variable with respect to the various independent variables. By summing the regression coefficients, the degree of homogenity can be determined.

Nominal Return to Equity Shares

If equity yields in nominal terms are a function of nominal bond

yields, then the nominal price to earnings ratio must be functionally related to nominal bond yields also. Or:

$$\frac{E_t}{ESP_t} = f_3(rn_t, \varepsilon_3); \frac{\partial f_3}{\partial rn_t} > 0 \qquad (5)$$

Where: $rn_t$ = the nominal rate of interest at time t.

By comparing rates of return in this manner, the influences on the price level and inflation have been included for consideration.

By functionally solving for $ESP_t$ in equation (5)

$$ESP_t = f_4(E_t, rn_t, \varepsilon_4); \frac{\partial f_4}{\partial E_t} > 0, \frac{\partial f_4}{\partial rn_t} < 0. \qquad (6)$$

In that form, equation (2) becomes:

$$ESP = a_{20} + a_{21}E + a_{22}\, rn + \varepsilon_4. \qquad (7)$$

The result of the regression should show that positive nominal earnings are positively related to nominal equity share prices since an increase in nominal earnings would necessitate an increase in nominal equity share prices to maintain a nominal rate of return comparable to other nominal rates of return. The nominal rate of interest, on the other hand, should be negatively related to nominal equity share prices since an increase in nominal interest rates is indicative of an increase in the nominal rates of return from other forms of wealth. The nominal rate of return from equity shares as is represented on the left side of equation (5) can be equilibrated to other nominal rates of return by the wealth-owner causing real equity share prices to decrease. In

logarithmic form, equation (6) becomes:

$$\ln ESP = \ln a_{30} + a_{31} \ln E + a_{32} \ln rm + \ln \varepsilon_4. \qquad (8)$$

By comparing the results of the above regression equations, it will become apparent, which form best explains the level of equity share prices.

## Interest Rates

Irving Fisher postulated that the nominal market rate of interest was primarily dependent upon the real rate of interest, and expectations of the rate of inflation. For many years, this formulation has been an important concept in monetarist thought.

Recently, Thomas J. Sargent[6] modified this concept. His basic model was:

$$rm_t = re_t + (rm_t - re_t) + (rm_t - rm_t) \qquad (9)$$

Where: $re_t$ = the real equilibrium rate of interest equating an investment function in real terms with a savings function in real terms at time t.

## The Real Equilibrium Rate of Interest

The (re) term in equation (9) is derived from equating real ex ante savings and real ex ante investment, or:

$$S_t = f_5 (rm_t, X_t); \quad \frac{\partial f_5}{\partial rm_t} > 0, \frac{\partial f_5}{\partial X_t} > 0 \qquad (10)$$

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[6]Thomas J. Sargent, "Commodity Price Expectations and the Interest Rate," The Quarterly Journal of Economics, Vol. 83, No. 1, (February, 1969), pp. 127-140.

$$i_t = f_6 (rm_t, \Delta X_t); \frac{\partial f_6}{\partial rm_t} < 0, \frac{\partial f_6}{\partial \Delta X_t} > 0 \qquad (11)$$

Where

$X_t$ = the real level of output at time t

$\Delta X_t$ = changes in the level of real output at time t required to absorb past savings

$i_t$ = the real investment schedule at time t

$S_t$ = the real savings schedule at time t.

Equation (11) reflects an accelerator hypothesis modified to allow for the effects of $rm_t$. Equation (10) is a Keynsian savings function. Equations (10) and (11) assume the absence of the money illusion since both functions have the real rather than the nominal rate as an argument. The condition for equilibrium is the equality of ex ante savings and investment. The rate $re_t$ is then the rate which solves the equation:

$$ED_t = i_t - S_t = 0 \qquad (12)$$

Where: $ED_t$ = the excess demand for loanable funds at time (t).

Solving the equilibrium rate produces the equation:

$$re = f_7 (\Delta X_t, X_t); \frac{\partial f_7}{\partial \Delta X_t} > 0, \frac{\partial f_7}{\partial X_t} < 0. \qquad (13)$$

In equation (12), an increase in the rate of increase of output positively shifts the demand for funds for investment and causes an increase in the equilibrium rate of interest. Alternatively, a one-time increase in the level of output generates a large volume of savings,

diminishing the equilibrium rate of interest.

The Real Rate of Interest

The real equilibrium rate of interest subtracted from the real market rate of interest creates a gap, due in part, to the monetary authority increasing or decreasing the money supply. The operations of the monetary authority generate supplies of, and demands for funds which augment those due to the real ex ante savings and real ex ante investment functions. The difference between ($rm_t$) and ($re_t$) is due to relative changes in the real stock of money. Therefore:

$$(rm_t - re_t) = f_8\left(\frac{\Delta m_t}{m_{t-1}}\right); \; f'_8 < 0 \qquad (14)$$

Where: $m_t$ = the real supply of money at time t.

An increase in the real money supply initially decreases the real market rate of interest with respect to the real equilibrium rate. Also, an increasing level of prices causes the real market rate of interest to increase by reducing the value of real money balances.

By rearranging equation (14), the real market rate of interest can be functionalized into the form:

$$rm_t = f_8 + re_t \qquad (15)$$

By combining the two terms on the right side of equation (15) into a single functional form:

$$rm_t = f_9\left(\frac{\Delta m_t}{m_{t-1}}, X_t, \Delta X_t\right); \frac{\partial f_7}{\partial \frac{m_t}{m_{t-1}}} < 0, \frac{\partial f_9}{\partial X_t} < 0, \tag{16}$$

$$\frac{\partial f_9}{\partial \Delta X_t} > 0.$$

It is now possible to expand equation (2) by replacing the real market interest rate with its functionally related parts.

The resulting functional equation is:

$$ESP/P_t = f_{10}(E_t/P_t, \Delta m_t/m_{t-1}, \Delta X_t, X_t, E_{5t}); \frac{\partial f_{10}}{\partial \frac{E_t}{P_t}} > 0, \tag{17}$$

$$\frac{\partial f_{10}}{\partial (\Delta m_t/m_{t-1})} > 0, \frac{\partial f_{10}}{\partial \Delta X_t} < 0, \frac{\partial f_{10}}{\partial X_t} > 0.$$

By linearizing equation (17) it will be in a form compatible with regression:

$$RESP = a_{40} + a_{41}RE + a_{42}PCRM_s + a_{43}CRX + a_{44}RX + \varepsilon_5 \tag{18}$$

Where: $PCRM_s$ = percent change in the real money supply, i.e., $\frac{\Delta m_t}{m_{t-1}}$

CRX = real change in output, i.e., $\Delta X_t$

RX = real output, i.e., $X_t$.

Positive real earnings will have a positive effect upon real equity share prices for reasons mentioned above. Positive percentage changes in the real money supply should also have positive effects on real equity share

prices because of their negative effect upon the real market rate of interest.

Assuming that the equilibrium rate of interest ($re_t$) transmits the same type of effect upon the real equity share prices as other rates of interest do, then positive real changes in output, through their positive affect on the real equilibrium rate of interest, negatively affect real equity share prices. Conversely, negative real changes in output would positively affect real equity share prices.

Real output is negatively related to the real equilibrium rate of interest and therefore should be positively related to real equity share prices.

Expressing equation (18) in logarithmic linear stochastic form:

$$\ln RESP = \ln a_{50} + a_{51}\ln RE + a_{52}\ln PCRM_s + a_{53}\ln CRX + a_{54}\ln RX + \ln \varepsilon_5. \quad (19)$$

The Rate of Inflation

The real market rate of interest subtracted from the nominal rate of interest represents the Fisher effect. The difference is represented by the rate of inflation expected. This is the premium put on real market interest rates by lenders to insure that in real terms, the real flow of returns in period (t) from a debt instrument will equilibrate to the real flow of returns in period t + 1.

$$(rn_t - rm_t) = [P^*(t+1) - P_t]/P_t \quad (20)$$

Where: $P^*(t+1)$ = expected price level in period $(t+1)$.[7]

If investors predicate their expectations of the rate of inflation from the existing rate of inflation, then equation (20) may be rewritten as:

$$(rn_t - rm_t) = \frac{P_t - P_{t-1}}{P_{t-1}} \qquad (21)^8$$

By rearranging equation (20) the nominal rate of interest can be functionalized.

$$rn_t = f_9 + \frac{P_t - P_{t-1}}{P_{t-1}}$$

By combining the two terms on the right side of equation (20)

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[7]Sargent, op. cit., p. 132. Sargent's approach was similar to Fisher's approach, in that Sargent assumed that the $rn_t - rm_t$ arose as a result of anticipated commodity price inflation. Sargent further assumed that the expected average proportionate rate of price inflation over the term of a loan was a distributed lag function of actual current and past rates of inflation. The relationship was:

$$rn_t - rm_t = \frac{\sum_{i=0}^{\infty} W(i)\, P_{(t-i)} - P_{(t-i-1)}}{P_{(t-i-1)}}$$

Where: W = the weight assigned to past observations
i = the timer period deviation from time t.

[8]If investors predicate their expectations of the future rate of inflation from previous rates as well as the present rate, then an adaptive expectations mechanism would be the appropriate explanation for the gap between nominal and real market rates of interest.

into a single functional form:

$$rm_t = f_{11}(\Delta m_t/m_{t-1},\ \Delta X_t,\ X_t,\ \Delta P_t/P_{t-1});\ \frac{\partial f_{11}}{\partial(\Delta m_t/m_{t-1})} < 0,$$

$$\frac{\partial f_{11}}{\partial \Delta X_t} > 0,\ \frac{\partial f_{11}}{\partial X_t} < 0,\ \frac{\partial f_{11}}{\partial(\Delta P_t/P_{t-1})} > 0. \qquad (23)$$

It is now possible to expand equation (5) by replacing the nominal interest rate with its functionally related parts. The resulting functional equation is:

$$ESP_t = f_{12}(E_t,\ \Delta m_t/m_{t-1},\ \Delta X_t,\ X_t,\ \Delta P_t/P_{t-1},\ \varepsilon_6);\ \frac{\partial f_{12}}{\partial E_t} > 0,$$

$$\frac{\partial f_{12}}{\partial(\Delta m_t/m_{t-1})} > 0,\ \frac{\partial f_{12}}{\partial \Delta X_t} < 0,\ \frac{\partial f_{12}}{\partial X_t} > 0,\ \frac{\partial f_{12}}{\partial(\Delta P_t/P_{t-1})} < 0. \qquad (24)$$

Linearizing equation (24) into a form compatible with regression:

$$ESP = a_{60} + a_{61}E + a_{62}PCRM_s + a_{63}CRX + a_{64}RX + a_{65}RI + \varepsilon_6 \qquad (25)$$

Where: $\kappa I$ = rate of inflation.

All real variables mentioned under equation (18) should have the same sign as their nominal counterparts in equation (24). The additional variable in equation (24), the rate of inflation, if positive, is directly related to the rate of nominal interest. Therefore, if positive, it should be inversely related to equity share prices.

In logarithmic linear stochastic form, equation (24) becomes

$$\ln ESP = \ln a_{70} + a_{71}\ln E + a_{72}\ln PCRM_s + a_{73}\ln CRX + a_{74}\ln RX + a_{65}\ln RI + \ln \varepsilon_6. \qquad (26)$$

## Real Net Earnings

Positive real net earnings yield a positive real return to equity shareholders. Real net earnings are determined by the level of demand for goods and the cost of producing those goods. One important factor in the determination of the cost of production is the utilization rate of capital equipment.

## Index of Utilized Capital Equipment

If corporations have idle capital equipment, then the positive return from the capital is zero. Regardless of the source from which funds were obtained to buy the capital, the cost of the equipment is positive. Idle capital, then would tend to decrease real net earnings.

If, on the other hand, capital were being over-utilized due to greatly increased demands for consumer goods, inefficiencies would also be present, again causing real net earnings to be less than optimal.

An index was developed to capture the effect of the level of capital utilization on real net earnings. The variable used in the construction of this index was the rate of unemployment of the labor force (U). It was assumed that deviations from full employment of the labor force would be proportionate to deviations from full employment of capital equipment.

In 1962, The Annual Report of the President's Council of Economic Advisors determined that the rate of four percent unemployment of the labor force was a reasonable and prudent target for stabilization

policy.[9] Four percent of the labor force unemployed has since been used as a standard percentage figure to represent full employment of the labor force. To represent this percentage as the point where real net earnings were not adversely affected, the following index was constructed:

$$U_t = \left| 1 - \frac{\dot{U}_t}{.04} \right| \qquad (27)$$

Where: $U_t$ = an index of utilized capital equipment.

$\dot{U}_t$ = the rate of unemployment of the labor force.

If the level of unemployment of the labor force were four percent, the index value would be zero indicating no loss of production efficiency. On either side of four percent, the value of the index coefficient should be inversely related to the level of production efficiency and real net earning.

Demand Variables

Variables that affect the demand for goods are real output, changes in real output and real percent changes in the money supply. Real output is the real value of all final goods and services produced by the economy during an income period. Therefore, this variable represents the level of demand for goods and services in real terms. Changes in real output represent shifts in demand schedules for real goods and services. Both variables are assumed to be positively related to real net earnings.

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[9]Wallace C. Peterson, Income, Employment, and Economic Growth (New York: W. W. Norton and Company, Inc., 1967), p. 452.

The final variable is real percent changes in the money supply. Increases of this variable cause upward shifts in the real demand for consumer goods. Consumer goods are considered non-human wealth, a less-liquid form of wealth than money. A percent increase in the real money supply causes wealth-owners to adjust their portfolio composition in favor of less liquid assets. The demand for consumer goods shifts upward causing real net earnings to increase.

The functional form of real corporate earnings is:

$$E_t/P_t = f_{13}(X_t, \Delta X_t, \Delta m_t/m_{t-1}, U_t, \varepsilon_{7t}); \frac{\partial f_{13}}{\partial X_t} > 0$$

$$\frac{\partial f_{13}}{\partial \Delta X_t} > 0, \frac{\partial f_{13}}{\partial (\Delta m_t/m_{t-1})} > 0, \frac{\partial f_{13}}{\partial U_t} < 0. \quad (28)$$

Equation (2) can now be expanded. This time $rm_t$ will be left as in equation (2), but real earnings will be expanded into its component parts. Or:

$$ESP_t/P_t = f_{14}(rm_t, \Delta m_t/m_{t-1}, \Delta X_t, X_t, U_t, \varepsilon_{7t}); \frac{\partial f_{14}}{\partial rm} < 0,$$

$$\frac{\partial f_{14}}{\partial (\Delta m_t/m_{t-1})} > 0, \frac{\partial f_{14}}{\partial \Delta X_t} > 0, \frac{\partial f_{14}}{\partial X_t} > 0, \frac{\partial f_{14}}{\partial U_t} < 0. \quad (29)$$

Linearizing equation (29) into a form compatible with regression:

$$RESP = a_{80} + a_{81}rm + a_{82}PCRM_s + a_{83}CRX + a_{84}RX + a_{85}U + \varepsilon_7. \quad (30)$$

In logarithmic linear stochastic form, equation (29) becomes:

$$\ln RESP = \ln a_{90} + a_{91}\ln rm + a_{92}\ln PCRM_s + a_{93}\ln CRX + a_{94}\ln RX + a_{95}\ln U + \ln \varepsilon_7. \quad (31)$$

It is now possible to expand equation (16) by replacing real net earnings with its functionally related parts. The resulting functional equation is:

$$ESP_t/P_t = f_{15}(\Delta m_t/m_{t-1},\ \Delta X_t,\ X_t,\ U_t,\ \varepsilon_{8t});\ \frac{\partial f_{15}}{\partial(\Delta m_t/m_{t-1})} > 0,$$

$$\frac{\partial f_{15}}{\partial \Delta X_t} \gtrless 0,\ \frac{\partial f_{15}}{\partial X_t} > 0,\ \frac{\partial f_{15}}{\partial U_t} < 0. \qquad (32)$$

Linearizing equation (27) into a form compatible with regression:

$$RESP = a_{100} + a_{101}PCRM_s + a_{102}CRX + a_{103}RX + a_{104}U + \varepsilon_8. \qquad (33)$$

Positive percent changes in the real money supply have been shown to have a negative effect on real market interest rates and a positive effect on real earnings. Therefore, positive changes of this variable should have a positive effect on real equity share prices.

Positive changes in real output should have a positive effect on both real market interest rates and real earnings. If positive changes in real market interest rates and real earnings have opposite effects upon real equity share prices, then the effect of positive changes in real output on real equity share prices cannot be determined a priori.

Positive real output has a negative effect upon real interest rates and a negative effect upon real earnings. Therefore, it should have a positive effect upon real equity share prices.

By its construction, increases in the index of utilized capital equipment should be negatively related to earnings, and therefore, real equity share prices. As the index approaches zero, real earnings

should increase.

In logarithmic linear stochastic form, equation (32) becomes:

$$\ln RESP = \ln a_{110} + a_{111}\ln PCRM_s + a_{112}\ln CRX + a_{113}\ln RX + a_{114}\ln U + \ln \varepsilon_8. \quad (34)$$

Nominal Net Earnings

Nominal net earnings differ from real earnings in that real net earnings eliminate the effect of the price level. If percent changes in the price level are added to equation (27) the result would be a functional equation that represented, among other things, the effect of inflation on earnings. A positive rate of inflation would indicate an increase in nominal earnings. It should also be realized that the rate of inflation is positively related to interest rates. If the rate of inflation becomes too great, investment decisions are postponed due to the accompanying high interest rates. The effect of high interest rates is a decrease in the rate of increase in aggregate employment, income, demand and corporate nominal earnings. The functional form of nominal net earnings is:

$$E_t = f_{16}(\Delta m_t/m_{t-1},\ \Delta X_t,\ X_t,\ \Delta P_t/P_{t-1},\ U_t,\ \varepsilon_9);\ \frac{\partial f_{16}}{\partial(\Delta m_t/m_{t-1})} > 0,$$

$$\frac{\partial f_{16}}{\partial \Delta X_t} > 0,\ \frac{\partial f_{16}}{\partial X_t} > 0;\ \frac{\partial f_{16}}{\Delta P_t} > 0,\ \frac{\partial f_{16}}{\partial U_t} > 0. \quad (35)$$
$$\partial P_{t-1}$$

Equation (6) can now be expanded. This time $rn_t$ will be left as in equation (6), but nominal earnings will be expanded into its

component parts. Or:

$$ESP_t = f_{17}(rn_t, \Delta m_t/m_{t-1}, \Delta X_t, X_t, \Delta P_t/P_{t-1}, U_t, \varepsilon_9);$$

$$\frac{\partial f_{17}}{\partial rn_t} < 0, \frac{\partial f_{17}}{\partial(\Delta m_t/m_{t-1})} > 0, \frac{\partial f_{17}}{\partial \Delta X_t} > 0, \frac{\partial f_{17}}{\partial X_t} > 0, \frac{\partial f_{17}}{\frac{\Delta P_t}{\partial P_{t-1}}} > 0,$$

$$\frac{\partial f_{17}}{\partial U_t} < 0. \tag{36}$$

Linearizing equation (34) into a form compatible with regression:

$$ESP = a_{120} + a_{121}rn + a_{122}PCRM_s + a_{123}CRX + a_{124}RX + a_{125}RI + a_{126}U + \varepsilon_9. \tag{37}$$

In logarithmic linear stochastic form, equation (36) becomes:

$$\ln ESP = \ln a_{130} + a_{131}\ln rn + a_{132}\ln PCRM_s + a_{133}\ln CRX + a_{134}\ln RX + a_{135}\ln RI + a_{136}\ln U + \ln\varepsilon_9. \tag{38}$$

It is now possible to expand equation (24) by replacing the nominal earnings variable with its functionally related parts. The resulting functional equation is:

$$ESP_t = f_{18}(\Delta m_t/m_{t-1}, \Delta X_t, X_t, \Delta P_t/P_{t-1}, U_t, \varepsilon_{10});$$

$$\frac{\partial f_{18}}{\partial(\Delta m_t/m_{t-1})} > 0, \frac{\partial f_{18}}{\partial \Delta X_t} \gtrless 0, \frac{\partial f_{18}}{\partial X_t} > 0, \frac{\partial f_{18}}{\frac{\Delta P_t}{\partial P_{t-1}}} < 0,$$

$$\frac{\partial f_{18}}{\partial U_t} < 0. \tag{39}$$

Linearizing equation (37) into a form compatible with regression:

$$ESP = a_{140} + a_{141}PCRM_s + a_{142}CRX + a_{143}RX + a_{144}RI + a_{145}U + \varepsilon_{10}. \tag{40}$$

The variables in equation (39) have identical directions of effect on the dependent variable to those same variables found in equation (32). The coefficient ($a_{145}$) of the new variable, the rate of inflation, should be negative when regressed against nominal equity share prices.

The direct effect of a positive rate of inflation is to increase prices and therefore nominal earnings. At the same time, a positive rate of inflation causes interest rates to increase. This, in turn, causes decreases in the rate of increase of investment, employment, income, and eventually earnings. A priori, the net effect of increases in the rate of inflation on equity share prices should be negative.

In logarithmic linear stochastic form, equation (31) becomes:

$$\ln ESP = \ln a_{150} + a_{151}\ln PCRM_S + a_{152}\ln CRX + a_{153}\ln RX + a_{154}\ln RI + a_{155}\ln U + \ln \varepsilon_{10}. \quad (41)$$

Each model was regressed and tested. The results of the regressions and testing will be presented in Chapter 4.

## Chapter 4

## DATA, EMPIRICAL RESULTS, AND COMMENTS

The 16 linearized equations of Chapter 3 were regressed in their additive or logarithmic forms. The results of the regression were examined to determine the relative explanatory power of the variables and the models.

### DATA

The equations were regressed using[1] quarterly data from the third quarter 1952, to the second quarter, 1972.[2] The following variables were used to fit the empirical equations.

#### Price Level

The consumer price index, all items, seasonally adjusted, was used to represent the price level. This price index is a comparison of like market basket costs between a base year (1958) and all other years.[3] The data was available in a monthly series only. To obtain

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[1]All time series data was available as listed in "Data Bank Retrieval Codes of Series in Central Data Banks," (Cambridge, MD: Data Resources, Inc., 1972), pp. 1-100.

[2]The length of this time span was sufficiently long to sample several business cycles, but was short enough to be after the "Accord" between the Treasury and the Federal Reserve.

[3]U.S. Department of Commerce, Office of Business Economics, Business Statistics 1961 Biennial Edition (Washington: U.S. Government Printing Office, 1961), p. 209.

quarterly data, the three monthly indices were arithmetically averaged. The quarterly index was then used to deflate quarterly nominal values and to compute the rate of inflation.

## The Rate of Inflation

The rate of inflation was derived by subtracting the previous quarter's price index from the present quarter's price index, then dividing the resultant value by the previous quarter's price index.

## Real and Nominal Equity Share Price Index

Standard and Poor's 425 Industrial Stock average represented the nominal equity share price index. Standard and Poor's monthly index is the arithmetic average of the four or five Friday closing price levels of all industrial stocks listed on the New York Stock Exchange.[4] The data was available in a monthly series only. To obtain quarterly data, the three monthly indices were arithmetically averaged. To obtain quarterly real equity share prices, the quarterly Standard and Poor's index was divided by the quarterly consumer price index.

## Real and Nominal Corporate Earnings

The variable, corporate profits after taxes excluding inventory valuation adjustment, was used to represent earnings. This variable represents "the earnings of corporations organized for profit which accrue to residents of the Nation, measured after Federal and State profit taxes."[5] From this value is subtracted "the excess of the value

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[4]Ibid., p. 251.

[5]Ibid., pp. 197-198.

of the change in the volume of nonfarm business inventories, valued at average prices during the period, over the change in book value of nonfarm inventories."[6] The data was available in a monthly series only. To obtain quarterly data, the three monthly values were arithmetically averaged. By dividing the quarterly data by the quarterly consumer price index, quarterly real earnings were obtained.

Real and Nominal Interest Rates

Moody's yield on AAA bonds was used to represent the nominal interest rate. The daily yield is based on the arithmetic average of the closing price of all AAA bonds. "The monthly series are averages of daily figures."[7] The data was available in a monthly series only. To obtain quarterly data, the three monthly yields were arithmetically averaged. By subtracting the quarterly rate of inflation from quarterly bond yields, the quarterly real rate of interest was approximated.

Percent Change in the Real Money Supply

The total money supply, which includes currency outside banks, demand deposits, and time deposits, was used to represent the nominal money supply. The data was available in a monthly series only. To obtain quarterly data, the three monthly values were arithmetically averaged. By dividing this value by the quarterly price index, the real money supply was obtained. By subtracting the previous quarter's real money supply from the current quarter's real money supply and dividing

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[6]Ibid., p. 197.

[7]Ibid., p. 249.

the result by the previous quarter's real money supply, the percent change in the real money supply was obtained.

Real Output and Changes in Real Output

Output was represented by gross national product which includes personal consumption expenditures, gross private and domestic investment, net exports of goods and services, and Government purchases of goods and services.[8] This data was available in a quarterly series. Quarterly GNP was divided by the quarterly consumer price index to represent real quarterly output. To obtain changes in real output, the previous quarter's level of real output was subtracted from the current quarter's level of real output.

Rate of Unemployment and the Index of Capacity Utilization

Unemployment rate - all civilian workers, was the variable used to represent the unemployment rate. The rate was available in a monthly series only. To obtain quarterly rates, the three monthly rates were arithmetically averaged. The quarterly rate was divided by .04. The absolute value of the resultant figure subtracted from one was then used as the index of capacity utilization.

## DATA LIMITATIONS

The consumer price index, Standard and Poor's 425 Industrial Stocks, Total Money Supply, Moody Yields on AAA Bonds, and the

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[8]Ibid., p. 4.

unemployment rate were available only in monthly series. To convert monthly data into quarterly data, arithmetic averaging was used, i.e., summing the three monthly values and dividing by three. By using arithmetic averaging, large deviations from the population regression line are averaged over adjacent periods causing each to be misrepresented. The sum of the deviations between consecutive error terms will tend to be proportionately less for the averaged data than for the unaveraged data. This will cause the sample regression equation to misrepresent the true relationship between the dependent variable and independent variables.

The dependent variable, the equity share price index, was arithmetically averaged. By using arithmetic averaging large, one month increases or decreases would be averaged out over adjacent periods. Regressing the averaged variable would tend to misrepresent the actual relationship between the dependent variable and the independent variables.

## REGRESSION RESULTS

The 16 linearized equations presented in Chapter 3 were fitted to quarterly data from 1952 through the second quarter of 1972. The results are presented below.

### Equations (1) and (2)

Both actual and logarithmic values for real earnings and the real market rate of interest were regressed against actual and logarithmic values for real equity share prices, respectively. The following

estimates were obtained:

$$\underset{(4.87176)}{RESP = -22.5687} + \underset{(.140005)}{1.95113RE} + \underset{(.931934)}{6.32531rm} \qquad R^2 = .8378,\ DW = .4387,\ SE = 8.85109 \qquad (1)$$

$$\underset{(.290845)}{lnRESP = -.00976} + \underset{(.0940054)}{1.002018lnRE} + \underset{(.0756072)}{.452971lnrm} \qquad R^2 = .8016,\ DW = .3696,\ SE = .156375 \qquad (2)$$

The regression coefficient of real earnings in both equations was positive, therefore it met a priori conditions. However, the regression coefficient of the real rate of interest was positive. Therefore, it did not meet a priori conditions.

Increases in the rate of change in real output have a negative effect on real equity share prices through increases in the real rate of interest. Increases in the rate of change in real output have a positive effect on real equity share prices through increases in real earnings. If these two effects were offsetting, then the two remaining components of real interest rates, real output and the percent change in the real money supply, would determine the effect that real interest rates had upon real equity share prices. But real output and percent changes in the real money supply are positively related to real equity share prices through their effects on real earnings and the real rate of interest. Therefore, if the effects of changes in real output are offsetting, then the regression coefficient of the real rate of interest would be positive.

Equations (3) and (4)

Both actual and logarithmic values for nominal earnings and the nominal rate of interest were regressed against actual and logarithmic values for nominal equity share prices, respectively. The following estimates were obtained.

$$\underset{\substack{(3.08499)}}{ESP = -19.6110} \underset{\substack{(.127076)}}{+ 1.85064E} \underset{\substack{(.888520)}}{+ 5.82660rn} \qquad \begin{matrix} R^2 = .9234 \\ DW = .4341 \\ SE = 7.65719 \end{matrix} \qquad (3)$$

$$\underset{\substack{(.218441)}}{lnESP = .128803} \underset{\substack{(.0912222)}}{+ .945912lnE} \underset{\substack{(.0962124)}}{+ .497645lnrn} \qquad \begin{matrix} R^2 = .8895 \\ DW = .2697 \\ SE = .150399 \end{matrix} \qquad (4)$$

The regression coefficient of nominal earnings was positive, therefore, it met a priori conditions. The regression coefficient of the nominal rate of interest was positive, and did not meet a priori conditions. These conditions were not met, in part, due to the off-setting of the effects of the rate of change in real output as mentioned above. Also, the effects of the rate of inflation on nominal equity shares prices through the rate of interest, could have been nullified by the effects of the rate of inflation on nominal equity share prices through nominal earnings. If this were the case, then only real output and percent change in the real money supply would be left to explain the nominal rate of interest. The regression coefficient of the nominal rate of interest would be positive.

Equations (5) and (6)

Both actual and logarithmic values for real earnings, the percent

change in the real money supply, change in real output and real output, were regressed against the actual and logarithmic values for real equity share prices.

$$\begin{aligned} RESP = {} & -22.4605 + 1.32504RE + 1.07031PCRM_s - .309665CRX \\ & (4.65463) \quad (.195781) \quad (1.61595) \quad (1.07058) \\ & + .07562RX \\ & (.0104312) \end{aligned} \tag{5}$$

$R^2 = .8531$
$DW = .2489$
$SE = 8.42479$

$$\begin{aligned} lnRESP = {} & -3.47224 + .648081nRE + .0040251nPCRM_s + .005031nCRX \\ & (.518492) \quad (.126292) \quad (.0231372) \quad (.0209455) \\ & + .840591nRX \\ & (.124172) \end{aligned} \tag{6}$$

$R^2 = .8155$
$DW = .1858$
$SE = .150805$

All regression coefficients of equation (5) have the anticipated sign, therefore meet a priori conditions. With the exception of the regression coefficient of changes in real output,[9] all regression coefficients of variables in equation (6) have the anticipated sign.

In equations (5) and (6), the real rate of interest is represented by its component parts. By representing the relationship in this way, the negative effect that the rate of change in real output

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[9]The regression coefficients of the independent variables of a linear regression represent marginal relationships between the dependent and independent variables. In logarithmic form, the regression coefficients of the independent variables represent the elasticities of the dependent variable with respect to the independent variables. Therefore, the absolute magnitude of the variable regressed has no effect upon the linear regression coefficients, but in logarithmic form, the larger the absolute magnitude of the variable regressed, the smaller will be that variable's regression coefficient. Also, through the comparing of effects in regression, regression coefficients that were positive in linear form, can become negative in the logarithmic form.

has upon real equity share prices through the real rate of interest, is sorted from the positive effect that the rate of change in real output has upon real equity share prices through real earnings.

Equations (7) and (8)

Both actual and logarithmic values for nominal earnings, the percent change in the real money supply, change in real output, real output, and the rate of inflation were regressed against actual and logarithmic values for nominal equity share prices, respectively. The following estimates were obtained:

$$\begin{array}{l} ESP = -42.3239 + .583018E + .991757PCRM_s + .26701CRX + .145345RX \\ \qquad\quad (4.93157) \quad (.2348) \quad (1.42044) \quad (.902627) \quad (.0183638) \\ \quad - 1.27198RI \\ \qquad (2.99533) \end{array} \qquad \begin{array}{l} R^2 = .9418 \\ DW = .3833 \\ SE = 6.67542 \end{array} \qquad (7)$$

$$\begin{array}{l} lnESP = -6.76962 + .324015lnE + .0133755lnPCRM_s + .0002121nCRX \\ \qquad\quad (1.01655) \quad (.167596) \quad (.022290) \quad (.0205951) \\ \quad + 1.51997lnRX - .041503lnRI \\ \qquad (.239847) \quad (.0208623) \end{array} \qquad \begin{array}{l} R^2 = .8999 \\ DW = .2868 \\ SE = .143142 \end{array} \qquad (8)$$

In equations (7) and (8), the nominal rate of interest is represented by its component parts. The regression coefficient of changes in real output was positive, therefore, it did not meet a priori conditions. A possible explanation is that by removing from nominal earnings the negative effect of the rate of inflation, the positive effect of the rate of inflation on nominal equity share prices became larger. This,

in turn, caused the positive effects of other nominal earnings variables on nominal equity share prices to decrease. One such variable was changes in real output. The excess positive effect of changes in real output on nominal equity share prices through earnings could have been picked up by the nominal interest rate's component of changes in real output. If this were the case, then the regression coefficient of changes in real output would be positive.

Equations (9) and (10)

Both actual and logarithmic values for real interest rates, percent change in the real supply of money, changes in real output, real output and the capacity utilization index were regressed against actual and logarithmic values for real equity share prices respectively. The following estimates were obtained:

$$\begin{array}{llllll} RESP = -42.3888 & - 14.0985rm & - .484711PCRM_s & + 2.21299CRX & + .236586RX & \\ \quad (6.70507) & (1.84983) & (1.54028) & (.946962) & (.0150927) & \\ + .170178U & & & & & \\ (.035817) & & & & & \end{array}$$

$R^2 = .8681$
$DW = .5354$
$SE = 7.98166$ (9)

$$\begin{array}{llll} lnRESP = -10.5490 & - .746847lnrm & + .011791lnPCRM_s & + .0315661lnCRX \\ \quad (1.07725) & (.140725) & (.021683) & (.019959) \\ + 2.17733lnRX & + .3801lnU & & \\ (.169970) & (.069797) & & \end{array}$$

$R^2 = .8390$
$DW = .4363$
$SE = .140866$ (10)

The signs of the regression coefficients for the real rate of interest, changes in real output, and real output were as anticipated.

The signs of the regression coefficients for percent changes in the real money supply and the index of capacity utilization were not as anticipated. It is possible that the components of real earnings affect future real earnings and expectations of present real earnings. If this were the case, then an increase in the percent change in the real money supply would add to the future rate of inflation. This, in turn, would add to the level of nominal interest rates which would negatively affect investment, income, and eventually future earnings. If increases in the percent change in the real money supply are detected by the equity share-owner, then he will anticipate that the real rate of return from equity shares will diminish. By readjusting his portfolio, wealth-owners will cause the real price of equity shares to decrease. Therefore, the regression coefficient of percent changes in the real money supply would be negative.

If the index of capacity utilization was also a component of real earnings that affected future real earnings and expectations of real earnings, then the index of capacity utilization would be positively related to real equity share prices through real earnings. The greater the amount of excess capacity available in the present time period, the greater the potential for future earnings. Therefore, the regression coefficient for the index of capacity utilization should be positive.

Equations (11) and (12)

Both actual and logarithmic values for percent change in the real money supply, changes in real output, real output, and the index

of capacity utilization were regressed against actual and logarithmic values for real equity share prices, respectively. The following estimates were obtained.

$$\begin{array}{lllll} RESP = -19.5067 & - .477862PCRM_s & + 2.33410CRX & + .131792RX & + .050962U \\ \quad (7.95634) & (2.04409) & (1.25653) & (.00825927) & (.0427374) \end{array}$$

$$R^2 = .7678 \quad DW = .2158 \quad SE = 10.5924 \qquad (11)$$

$$\begin{array}{llll} lnRESP = -5.63394 & + .0056704lnPCRM_s & + .0101578lnCRX & + 1.354771lnRX \\ \quad (.642201) & (.0252712) & (.0228143) & (.0814264) \end{array}$$

$$+ .242145lnU \quad (.0756081)$$

$$R^2 = .7807 \quad DW = .1338 \quad SE = .164409 \qquad (12)$$

The regression coefficients of real output and changes in real output are positive, as anticipated. The regression coefficients of the present change in the real money supply and the index of capacity utilization have signs opposite of those anticipated.

If the components of real earnings represent future real earnings as discussed in the previous argument, then the results of equations (11) and (12) provide evidence that the effects of the percent change in the real money supply and changes in real output on real equity shares are most predominant when exerted through real earnings.

Equations (13) and (14)

Both actual and logarithmic values for the nominal interest rate, percent changes in the real money supply, changes in real output, real

output, the rate of inflation and the index of capacity utilization were regressed against actual and logarithmic values for nominal equity share prices, respectively. The following estimates were obtained.

$$\begin{array}{l} ESP = -69.7988 - 7.60353rn + .231029PCRM_S + 1.10731CRX + .242398RX \\ \qquad\quad (4.79022) \quad (1.28658) \quad (1.16680) \qquad (.705096) \quad (.01248) \\ \qquad + 6.42473RI + .132024U \\ \qquad\quad (2.76830) \quad (.025426) \end{array} \qquad \begin{array}{l} R^2 = .9604 \\ DW = .5729 \\ SE = 5.50975 \end{array} \qquad (13)$$

$$\begin{array}{l} lnESP = -12.5355 - .417988lnrn + .0230614lnPCRM_S - .004591lnCRX \\ \qquad\quad (1.0309) \quad (.138017) \qquad (.0188378) \qquad (.0173147) \\ \qquad + 2.44382lnRX - .0262457lnRI + .333048lnU \\ \qquad\quad (.175598) \qquad (.0179435) \qquad (.0574289) \end{array} \qquad \begin{array}{l} R^2 = .9289 \\ DW = .2781 \\ SE = .120624 \end{array} \qquad (14)$$

With the exception of the index of capacity utilization, the regression coefficients of all variables were as anticipated.

The regression coefficient for the percent change in the real money supply is now positive. A possible explanation for this is that an increase in the percent change in the real money supply causes increases in the price level. The increase in the price level's effect on nominal equity share prices obscures the negative effects of percent changes in the real money supply on real equity share prices.

Equations (15) and (16)

Both actual and logarithmic values for percent change in the real money supply, changes in real output, real output, the rate of inflation, and the index of capacity utilization were regressed against actual and

logarithmic values for normal equity share prices, respectively. The following estimates were obtained.

$$\begin{array}{llllll} ESP = -56.7512 & + .581714PCRM_S & + 1.36251CRX & + .181764RX & + .708463RI & \\ \quad (5.13394) & \quad (1.40729) & \quad (.849924) & \quad (.00858075) & \quad (3.13248) & \\ + .0730043U & & & & & \\ \quad (.0282387) & & & & & \end{array}$$

$R^2 = .9422$
$DW = .4223$
$SE = 6.65396$ (15)

$$\begin{array}{llll} lnESP = -9.79961 & + .0195623lnPCRM_S & - .0038291lnCRX & + 1.950391lnRX \\ \quad (.523421) & \quad (.0198134) & \quad (.0182438) & \quad (.069014) \\ - .0399803lnRI & + .291272lnU & & \\ \quad (.0182944) & \quad (.0587452) & & \end{array}$$

$R^2 = .9210$
$DW = .3045$
$SE = .127110$ (16)

With the exception of the index of capacity utilization, all partial regression coefficients had the sign anticipated. When considered in a combined equation, such as equation (15), the negative effects of the percent change in the real money supply on real equity share prices are again obscured.

In Chapter 1, the statement was made that the demonstration of the money supply's effect on an aggregate equity share price index would be of prime importance to this study. The partial regression coefficients of the percent change in the real money supply have indicated that changes in this variable have relatively little effect upon equity share prices. It is possible that this variable may not have been accurately represented. In Chapter 5, recommendations to more accurately represent percent changes in the real money supply will be made.

Equation Regression Statistics

The range of the coefficients of determination was .76 to .96. Six of the coefficients of determination were greater than .90 indicating a relatively close fit between the data and the regression equations.

The Durbin-Watson statistics were sufficiently low to indicate positive serial correlation in all cases. This result is, in part, attributable to the averaging techniques required to convert monthly data into quarterly data. The largest part must be assumed to be due to the cyclical movements of the data observed, and a degree of multicollinearity. The result of this low statistic is that the variance of the sampling distribution for the regression coefficients are under-estimated.

# Chapter 5

## RECOMMENDATIONS

During this research effort, it was apparent that alternative techniques might have yielded a better representation of the interaction of macroeconomic variables and equity share prices.

The use of two alternative variables could possibly improve this representation. By replacing Chapter 3's index of capacity utilization with the Federal Reserve Bank's utilization of capacity index, or by replacing the consumer price index with the GNP price deflator, it is possible that the level of equity share prices would be more accurately explained.

As was mentioned in Chapter 4, the averaging technique used to convert monthly into quarterly data, tended to distort the representation of macroeconomic variables and equity share prices. To reduce this distortion, two alternative techniques are suggested. First, by randomly selecting one observation of a variable within a quarter, and by letting that observation be representative of all observations within that quarter, the interdependence between consecutive quarterly observations would be reduced. Rather than having all observations within a quarter smoothed, as happens with averaging, the proposed method would introduce a degree of independence to the quarterly observations.

The second proposed method of converting monthly to quarterly data is to take a weighted average of monthly observations. This technique would be applicable to corporate bond yields. It could be assumed

that the dollar volume of new corporate bonds was indicative of anticipated net returns from capital. By weighting monthly bond yields by the dollar volume of new corporate bonds, more weight would be given to those months in which anticipations of net returns from capital were greatly disturbed. The quarterly bond yield variable would, therefore, more accurately reflect the interaction of rates of return from bonds and the price of equity shares.

The results presented in Chapter 4 yield evidence that expectations of future earnings greatly affect present equity share prices. To more accurately represent these expectations, an adaptive expectations mechanism employing a distributed lag technique would seem appropriate. To employ this technique, the assumption must be made that expectations of future earnings are determined by modifying previous expectations in light of current experience. By applying this technique to earnings or to those components of earnings that influence future earnings, the effects of expectations could be more accurately represented.

It was mentioned in Chapter 3, that Sargent used an expectations mechanism to capture the effects of expected rates of inflation on interest rates. If this technique does more accurately represent expectations than the techniques of this study, then by using it in the equity share price model of Chapter 3, a more accurate explanation of the level of equity share prices would be possible.

Sprinkel argued that increases in the money supply preceeded

increases in equity share prices.[1] Possibly, a more accurate representation of the effects of past disturbances in the money supply have upon equity share prices could be incorporated into the model by lagging the percent change in the real money supply by one or two periods. Possibly, a more accurate demonstration of the money supply's effect upon an aggregate equity share price index would result.

In Chapter 3, equation (11) reflected an accelerator hypothesis. The variable that emerged from that equation may not have accurately represented in the interaction between changes in investment expenditures and changes in output. If the interaction between these two variables is not instantaneous, then possibly the effects of the rate of change in output were not accurately represented. This situation could be rectified by incorporating pasted changes in output into the model.

## CONCLUDING REMARK

Hopefully this study will stimulate interest in macroeconomic equity share valuation models. If, from this study, a better understanding of equity share valuation process has been imparted, then the author has realized a positive return from his effort.

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[1]Beryl W. Sprinkel, Money and Markets, A Monetarist View (Homewood, Illinois: Richard D. Irwin, Inc., 1971), p. 25.

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